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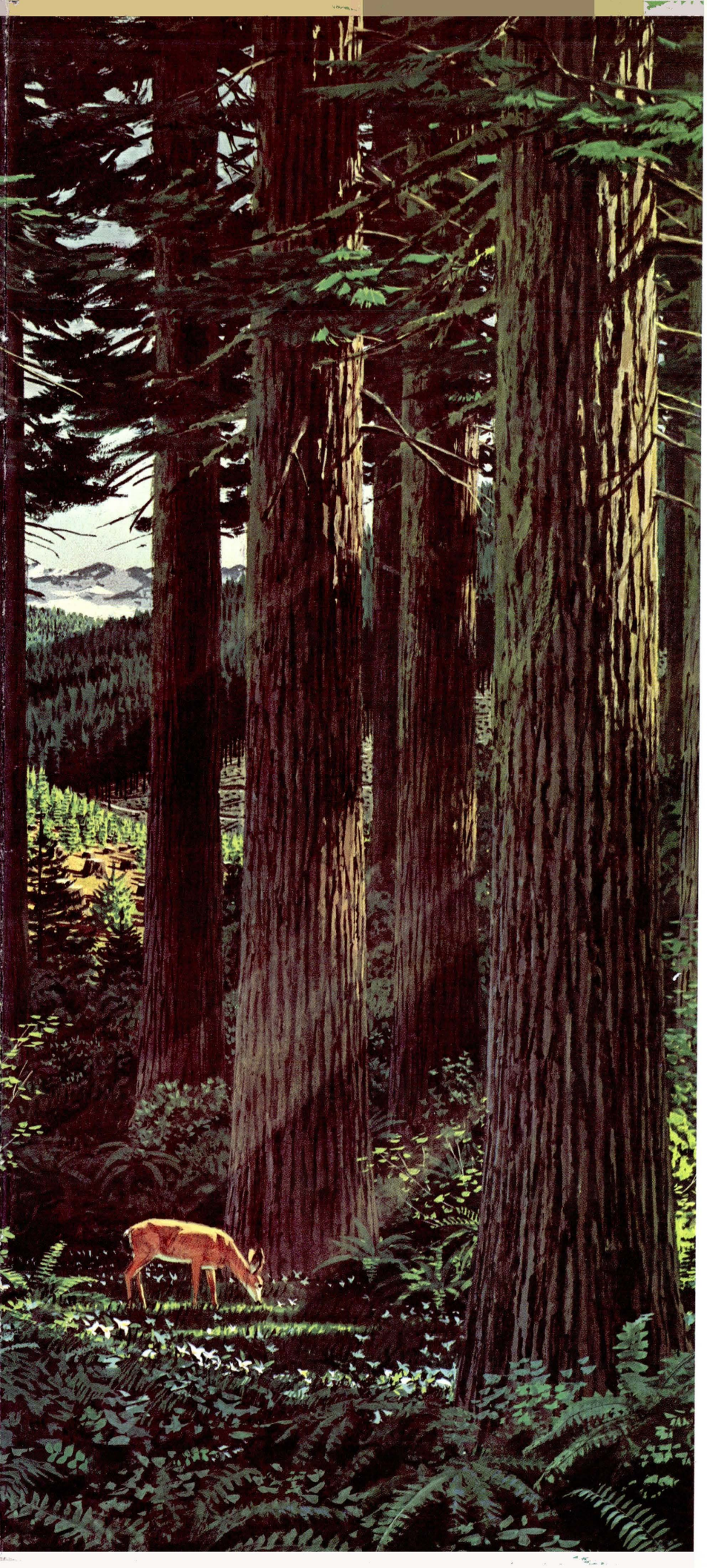

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Distribution of Sitka Spruce Weevil Eggs on Leaders of Open-Grown Spruce in Southwest Washington

by
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ABSTRACT

JOHNSON, NORMAN E. (Weyerhaeuser Company, Centralia, Wash.) Distribution of Sitka Spruce Weevil Eggs on Leaders of Open-grown Sitka Spruce in Southwest Washington. The Sitka spruce weevil, Pissodes sitchensis Hopk. was found to commence oviposition near the tip of the leader of Sitka spruce Picea sitchensis (Bong.) Carr. As the season progressed, the weevil moved further down the terminal, ovipositing with decreasing frequency until reaching the node. Most eggs were laid on the side of the terminal (northeastern) away from the afternoon sun. Up to six eggs were found in a single oviposition puncture. Eggs laid near the leader tip hatch before those laid farther down the leader. Comparisons are made with the white pine weevil.

DISTRIBUTION OF SITKA SPRUCE WEEVIL EGGS ON LEADERS OF OPEN-GROWN SITKA SPRUCE IN SOUTHWEST WASHINGTON[1]

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INTRODUCTION

According to Keen (1938) the Sitka spruce weevil (Pissodes sitchensis Hopk.) is the insect most damaging to Sitka spruce (Picea sitchensis (Bong.) Carr.) regeneration. Wright and Baisinger (1956) state that "Damage has become so severe that the advisability of planting this valuable fast-growing tree or encouraging it in natural stands is being questioned". Wright (1960) reports that in some years 40-50 per cent of trees in a stand may be weeviled. Trees attacked over many years are malformed and generally worthless for lumber.

Although the Sitka spruce weevil was among the first forest insects to be studied in western United States (Hopkins, 1911) little has been done to combat it. Work on the effect of the weevil on its host (Wright and Baisinger, 1956) and some small-scale insecticide treatments in British Columbia (Silver, 1962) is the only research reported. Preliminary to chemical control studies, information on where the adults oviposit is needed. This study reports the distribution of eggs in relation to distance from the terminal bud and in relation to sunlight.

METHODS

During the first week in June 1963, leaders were collected from open-grown Sitka spruce--ten from near Wynoochee Valley and 14 on the Clemons Tree Farm near Elma, Washington, from trees 15-45 feet in height. Only leaders showing signs of oviposition and feeding were taken. In late August an additional 14 samples were taken on the Clemons Tree Farm in the vicinity of the previous collections. Prior to

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[1]The author thanks Mr. Dick Pierson, formerly with Weyerhaeuser Company, for his assistance on this study, and Mr. K. H. Wright of the U. S. Forest Service for reviewing the manuscript.

cutting the leader, its southwestern side was marked. In the laboratory the leader was marked off in 4-inch sections from the top. The oviposition and feeding punctures on the southwestern half and northeastern half were tallied. Each oviposition puncture was opened and the number of eggs counted. The eggs on the upper sections of the leaders from the Clemons area had hatched; thus a count could not be made for this group.

RESULTS

Paired and single weevils were observed feeding and ovipositing on spruce leaders from late May through mid July, with greatest activity in June (Fig. 1A). Oviposition is confined to the leader or leaders. The weevil chews out a round hole, less than a millimeter in diameter, in the bark through which she excavates an oviposition chamber several times as large as the opening and deposits her eggs. Then she fills the hole with a plug of frass which later turns black and resembles the fruiting body of certain leaf-infecting fungi (Fig. 1C). Punctures not containing eggs may have been constructed for feeding. Sometimes drops of resin exude from the weevil punctures and the reflected sunlight can be seen from the ground. Usually, however, the weevils are not successful in leaders that exude much resin.

Figure 2 shows clearly the concentration of eggs near the tip early in the period of oviposition. Figure 2A shows the distribution of eggs at Wynoochee, where weevil activity lagged about two weeks behind that at Clemons. The dark bars in Figure 2B indicate the distribution of eggs at Clemons in June. The light bars show the distribution after all oviposition had ceased. Note the increased number of eggs lower on the leader at the later examination.

The eggs near the tip hatch first, again indicating earlier oviposition in the tip region (Fig. 3). If eggs were deposited randomly on the leader and hatched in order of oviposition, those larvae farthest from the tip would destroy the food supply of larvae working their way downward.

At Wynoochee more ovipositing punctures contained two eggs than any other number (Fig. 4A) but some punctures had five and six eggs in each (Fig. 1D). At Clemons the most common number of eggs per puncture was one (Fig. 4B). At both locations a high percentage of the punctures contained no eggs. The extreme right hand pair of bars in Figure 4B indicates the percentage of eggs already hatched at the time of examination. The larvae had already moved from the puncture and

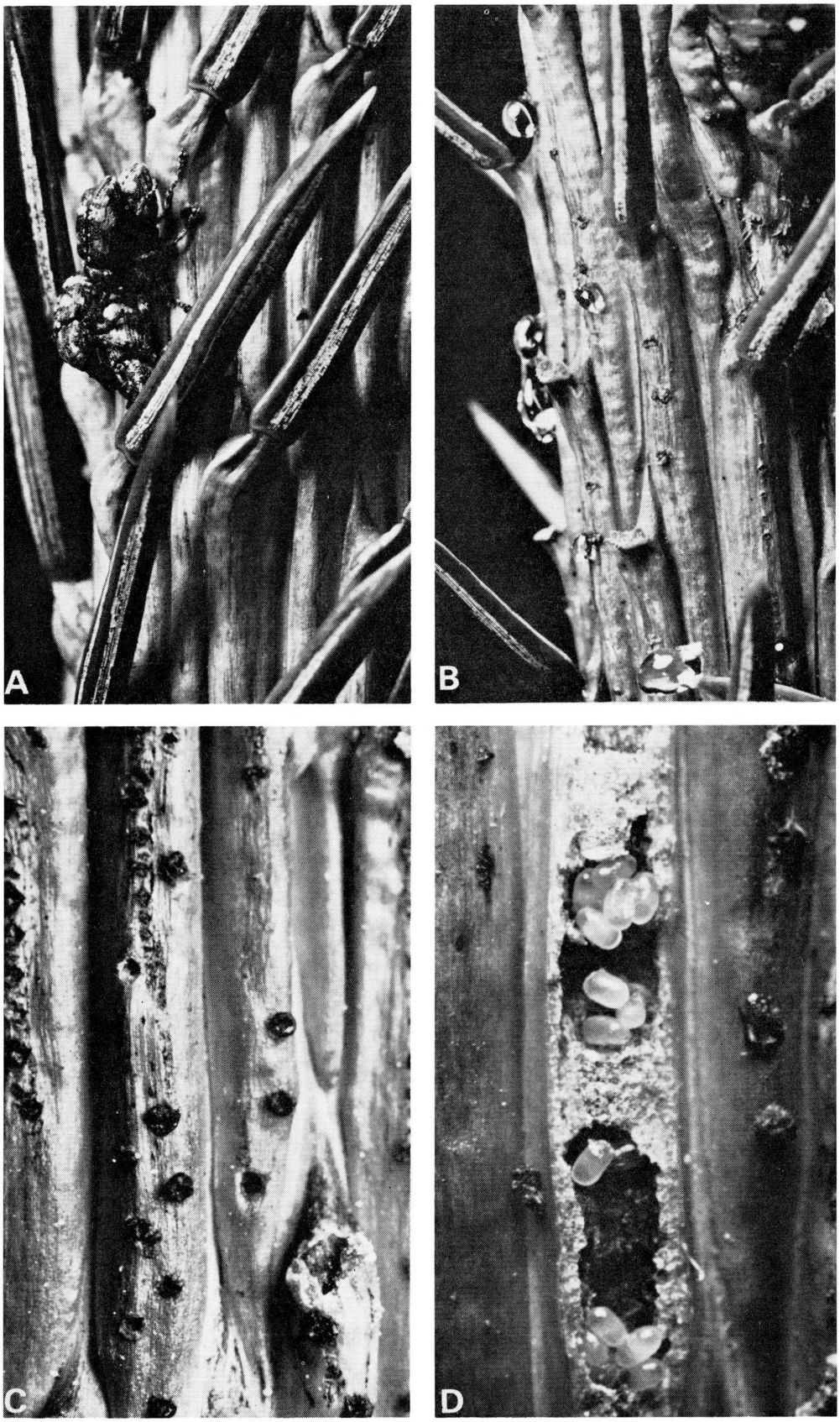

Figure 1. (A) Two pairs of Sitka spruce weevils on leader; (B) drops of resin, often indicative of weevil activity; (C) weevil oviposition sites; (D) four oviposition punctures opened to show weevil eggs.

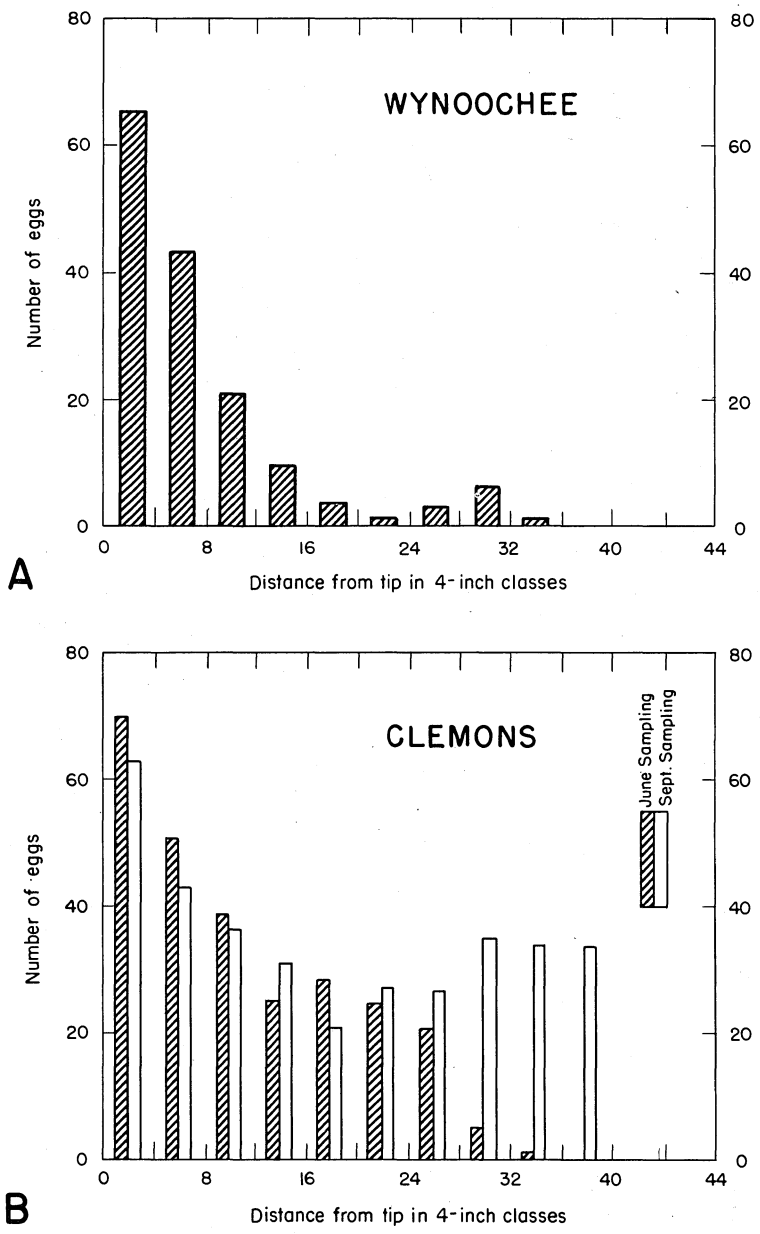

Figure 2. (A) Relationship between number of eggs laid through June 15 by the Sitka spruce weevil and the distance from the tip of the leader. (B) Same for Clemons, but with a comparison of total eggs laid.

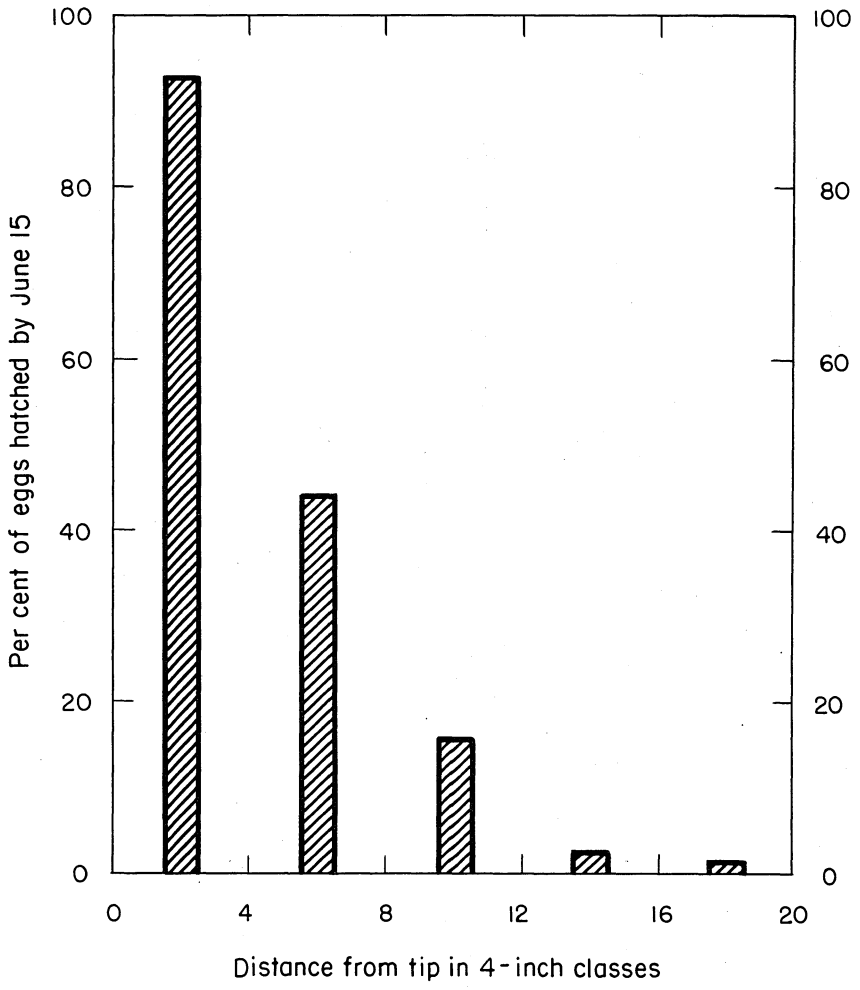

Figure 3. Relationship between the per cent of egg hatch on June 15 and distance of oviposition site from leader tip.

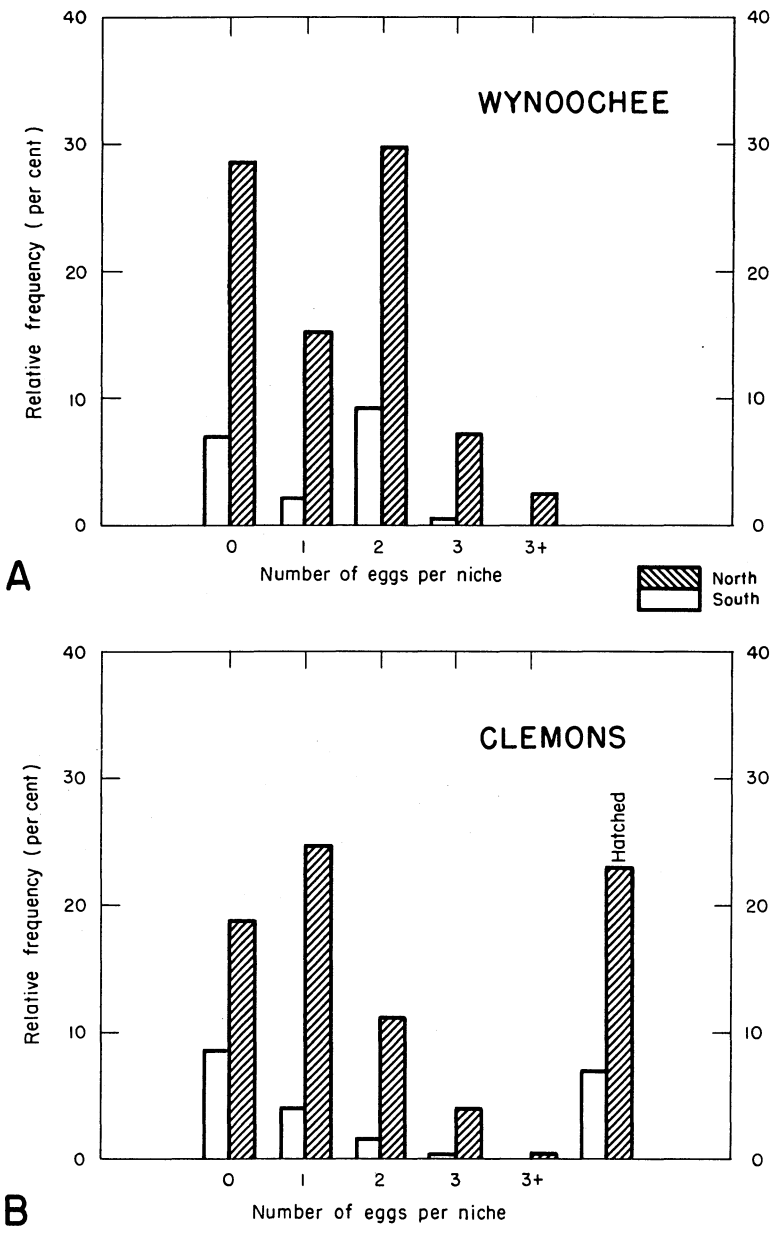

Figure 4. (A) Relative frequency of number of Sitka spruce weevil eggs on shaded (northeastern) and sunny (southwestern) side of the leader at Wynoochee. (B) Same for Clemons but with extreme right hand pair of bars showing eggs already hatched.

it was impossible to tell how many eggs had been laid. A few eggs had hatched at Wynoochee, but the tiny larvae were for the most part still within the puncture and could be tabulated as eggs.

Comparison of the light with the dark bars in Figure 4 shows the preference of the weevil for the shaded or northeastern side of the leader. Even on leaders shaded by other trees this preference existed, but to a lesser degree. In some cases there were a number of punctures on the southwestern or sunny side, but these were confined to an area directly beneath a side branch that provided shade during part of the day.

Not all leaders attacked by the weevil are killed. Of 26 trees at Wynoochee that were examined and found to be attacked, 11 of the leaders survived. In all but one case, those that successfully resisted the weevil had fewer than average weevil punctures. In a few cases, larvae completed development in surviving leaders, but in general the larvae were killed by excessive amounts of resin. When weevil-damaged tissue heals over a scar is often visible externally (Fig. 5).

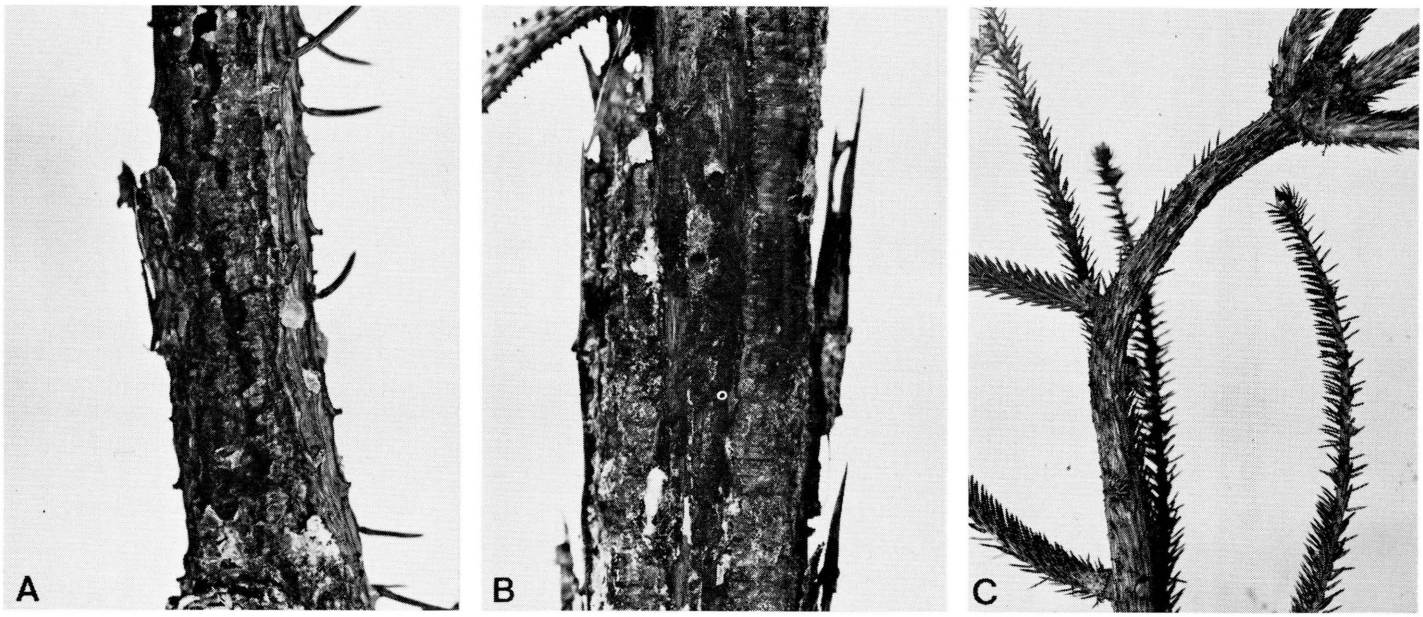

Figure 5. (A) Scar on spruce terminal resulting from light attack of weevil. (B) Scar from heavy attack that caused one whole side of leader to be killed--note pupal chambers made by weevils. (C) Terminal of spruce bent toward side that was successfully killed by weevil attack.

DISCUSSION

The Sitka spruce weevil is closely related to the white pine weevil, Pissodes strobi Peck. Hopkins (1911) identifies the latter by its smaller size, its narrower thorax, and its habits. The habits of the white pine weevil have been studied intensively in recent years, particularly by Sullivan (1961) who found that the white pine weevil commences feeding and ovipositing near the leader tip on exposed trees. Oviposition progresses downward as with the Sitka spruce weevil. Sullivan (1959) found that the white pine weevil prefers oviposition sites in direct sunlight, the adults moving around the leader as the day progresses. Our findings indicate that the Sitka spruce weevil prefers the shaded side of the leader on open-grown trees. Observations indicate that this preference is not as pronounced on shaded trees.

Wright (1960) indicates that the Sitka spruce weevil lays one or two eggs per puncture. Craighead (1950) reports one egg per puncture to be most common for the white pine weevil, although occasionally two or three were found. Our findings of up to six eggs per puncture should be considered in estimating number of eggs per terminal from a count of punctures alone.

Since the Sitka spruce weevil oviposits mainly on the side of the leader away from the afternoon sun, it is recommended that all ground or aerial spraying--if and when spray procedures are developed--be oriented so as to get full coverage on the shaded side.

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